## **CLAIMS**

We claim:

- A method for in line, real-time processing and monitoring of a semiconductor wafer 1 1.
- 2 comprising:
- creating a plurality of electron-hole pairs near a surface of the wafer; and 3
- heating the wafer to substantially desorb any contaminant adsorbed on the surface of the 4
- 5 wafer.
- The method of claim 1 wherein creating a plurality of electron-hole pairs comprises 1 2.
- 2 illuminating the wafer with radiation sufficient to create a plurality of electron-hole pairs near the surface of the wafer.
  - The method of claim 2 wherein heating the wafer comprises illuminating the wafer with a near infrared radiation.
  - The method of claim 2 wherein heating the wafer comprises placing the wafer on a hot 4. surface.
  - The method of claim 2 further comprising automatically controlling intensity and duration 5. of heating and illuminating steps.
- 1 The method of claim 2 further comprising measuring a temperature of the wafer during the 6.
- heating step and controlling intensity and duration of heating and illuminating steps based on the 2
- 3 measured temperature.
- The method of claim 2 wherein the wafer is heated and illuminated until a stable surface 1 7.
- condition is achieved. 2
- The method of claim 1 wherein heating comprises heating the substrate to a temperature in 1 8.
- 2 the range from about 200 °C to about 300 °C.

1 9. The method of claim 3 wherein illuminating with a near infrared radiation comprises illuminating with light having a wavelength in the range from about 0.2 microns to about 0.4 2 3 microns. 1 10. The method of claim 2 further comprising cooling the wafer after heating and illuminating 2 the wafer. 1 11. The method of claim 2 wherein the wafer is a p-type wafer and heating and illuminating 2 the wafer restores an inversion layer at the surface of the p-type wafer. The method of claim 2 wherein the wafer is a p-type wafer and heating and illuminating 1 12. 2 the wafer activates dopants previously deactivated due to interactions with contaminant ions. 13. The method of claim 1 further comprising: illuminating a portion of the wafer with a modulated light; and measuring an electrical characteristic of the wafer. 14. The method of claim 13 wherein measuring an electrical characteristic comprises measuring a photovoltage induced at the surface of the wafer. 15. The method of claim 14 further comprising calculating a carrier lifetime from the measured surface photovoltage. 1 16. The method of claim 14 further comprising determining a conductivity type from the 2 measured surface photovoltage. 1 17. The method of claim 14 further comprising determining a doping concentration from the 2 measured surface photovoltage. 1 18. An apparatus for surface treating a semiconductor wafer comprising: 2 a surface treatment chamber; and

- a source of radiation illuminating a semiconductor wafer disposed inside the chamber with
- 4 a radiation sufficient to create a plurality of electron-hole pairs near a surface of the wafer and to
- 5 desorb any contaminant adsorbed on the surface of the wafer.
- 1 19. The apparatus of claim 18 wherein the surface treatment chamber is integrated with an in-
- 2 line, real-time testing apparatus, such that electrical characteristics of the wafer can be measured.
- 1 20. The apparatus of claim 19 wherein a surface photovoltage of the wafer is measured after
- 2 the wafer has been surface treated.
- 1 21. The apparatus of claim 18 wherein the source of radiation comprises a tungsten halogen
- 2 quartz lamp.
- 1 22. The apparatus of claim 18 further comprising a plurality of reflectors disposed inside the
- 2 surface treatment chamber to provide uniform illumination of the wafer.
- 1 23. The apparatus of claim 18 further comprising a power control circuitry for controlling an
- 2 intensity of radiation from the radiation source.
- 1 24. The apparatus of claim 18 further comprising a temperature sensor for monitoring
- 2 radiation from the wafer during surface treatment.
- 1 25. The apparatus of claim 18 further comprising a filter disposed between the radiation
- 2 source and the wafer for filtering radiation having wavelength greater than about 4 microns.
- 1 26. The apparatus of claim 18 further comprising a first filter disposed between the radiation
- 2 source and the wafer, a second filter disposed adjacent the first filter, and an air passageway
- 3 disposed between the first filter and the second filter for cooling the filters, wherein the first filter
- 4 and the second filter prevents radiation having wavelengths greater than about 4 microns from
- 5 reaching the wafer.